

**Remarks**

Claims 28-31, 36-42, 50, 51, 55-62, 66-93 are pending in the application. The remaining claims have been canceled.

Claims 28, 36, 40 and 60 are amended herein to address the claim objections set forth on page 2 of the Office action to which this paper is responsive.

Claims 55, 66, 73 and 82 have been amended to include certain inhibitors inadvertently omitted previously. Support for the additional inhibitors may be found, for example, at page 8, lines 19-25 of the specification as filed.

Applicants respectfully request reconsideration of the claims of the present application based on the foregoing amendments and the following points.

**Claim Objections**

In the Office action, objection was made to the claims on the basis that the materials set forth in (ii) were within the scope of the materials set forth in (i).

Applicants have amended the independent claims to address this issue.

Accordingly, Applicants respectfully request withdrawal of this objection.

**Declaration of Nayan H. Joshi Under 37 CFR 1.132**

Applicants submit herewith the Declaration of Nayan H. Joshi under 37 CFR 1.132. Dr. Joshi is an inventor on the present application and is a person of skill in the art of metal finishing. As shown by the facts set forth in the Declaration, no person of ordinary skill in the art would have found it obvious or in any way suggested to employ in any immersion plating process a brightener which is both known and disclosed by the reference only for use in an electroplating bath. Brighteners are not used in immersion plating. Immersion plating is used to prepare a surface for subsequent electroless plating and/or electroplating. Brighteners have no place in immersion plating, at least because the deposited layer is quite thin and because the deposited layer is subsequently over-plated with a much thicker layer of metal deposited by the aforementioned electroless plating and/or electroplating. For these and additional reasons discussed in more detail below and in the Declaration, Applicants respectfully submit that the presently claimed invention would not have been obvious over the contended combination of Heiman and Eckles.

For these reasons, Applicants respectfully request the Examiner to withdraw the rejections of all of the pending claims over the contended combinations of references all based on Heiman in view of Eckles.

### Supplemental IDS

Applicants submit herewith a supplemental IDS to submit two new references. Appropriate consideration is requested.

### Conclusion

In view of the amendments to the claims and the foregoing remarks, it is respectfully submitted that all of the claims presently in the application fully patentably distinguish over the prior art and are in condition for allowance. Notice to such effect is respectfully requested.

In the event issues arise as a result of the filing of this paper, or remain in the prosecution of this application, Applicants request that the Examiner telephone the undersigned attorney to expedite allowance of the application.

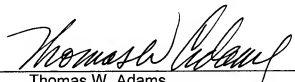
Should a Petition for Extension of Time be necessary for the present Reply to the outstanding Office action to be timely filed (or if such a petition has been made and an additional extension is necessary) petition therefor is hereby made and, if any additional fees are required for the filing of this paper, the Commissioner is authorized to charge those fees to Deposit Account #18-0988, Docket No. ATOTP0104US.

Respectfully submitted,

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**Rejections of Claims 28-31, 36-42, 50-59, 60-67, 71 and 72**

Claims 28-31, 36-42, 50-59, 60-67, 71 and 72 all stand rejected over the basic combination of Heiman, US 2580773 in view of Eckles, US 5405523, together with various tertiary references cited and invoked as needed to find all of the various features of the claimed invention. Applicants respectfully traverse the rejections of all these claims as based on Heiman in view of Eckles, with or without the secondary references.

Heiman teaches an immersion plating solution for depositing zinc on aluminum by a displacement plating reaction.

As admitted by the Examiner, Heiman fails to disclose any of the claimed (1) pH of the solution; (2) the presence of any inhibitor; or (3) the amounts of each material in the bath; (4) the presence of complexing agent or (5) the specific inhibitors claimed.

While it is correct that Heiman states that a thicker layer of zinc alloy can be plated by converting the bath to an electroplating bath, this does not support the Examiner's position. To the contrary, this disclosure points up and emphasizes the distinct and well known differences between immersion plating and electroplating. To wit, the immersion plating process is a chemical displacement process and can only proceed as long as atoms of the substrate remain free and uncovered by the deposited metal and thereby available for reaction. This necessarily limits the thickness of the immersion coating to a very thin layer. It is necessary to turn to either electroless plating or electroplating to obtain a thicker layer. However, no one of ordinary skill in the art would attempt to convert an immersion plating bath into an electroplating bath, despite that this could possibly be done as noted by Heiman. The chemistry is quite different, the deposited coating is quite different, and electroplating is much less economical for depositing a zinc alloy protective coating. Furthermore, as stated in the Declaration, the brighteners disclosed by Eckles et al. may interfere with the immersion plating. If the brighteners would be added only for converting the bath to electroplating, then the bath would be no longer an immersion plating bath, as claimed.

The Examiner attempted to fill the gaps left by Heiman by reference to Eckles, which as the Examiner also admitted, relates to electroplating. As Applicants have argued throughout the prosecution of this application, due to the many and well known differences between electroplating and immersion plating, the chemistry used in electroplating is not applicable to immersion plating, and for this reason alone, Applicants respectfully submit that Eckles in combination with Heiman could not have

rendered obvious the presently claimed invention. The differences between electroplating and immersion plating are deep and fundamental. Most obviously, immersion plating requires no externally applied electrical current to carry out the metal deposition as does electroplating. In immersion plating, the electrons are supplied by the base metal, which effectively acts as a reducing agent. Furthermore, the chemistry of the two kinds of baths is completely different. Thus, the person of ordinary skill in the art would not consider any chemistry taught by Eckles in its electroplating as being applicable to or providing any possibility of a reasonable expectation of success in modifying the immersion plating process of Heiman. There would be neither motivation nor reasonable expectation of success in any such modification.

As stated in the Declaration, there is no reason to add a brightener to an immersion plating bath. There is no function that could be performed by such an additive. Thus, no one would be motivated to add a brightener to an immersion plating bath.

The Examiner's contention that "it would have been obvious in both immersion and electroplating baths to add a brightener and complexing material, because it would be desired to improve the appearance of the resulting coating it [*sic*, in] all forms of coating" is clearly erroneous and is without support of any evidence whatsoever. This is nothing more than speculation on the part of the Examiner. Contrary to the Examiner's contentions, it would not have been obvious to add a brightener to an immersion plating bath, for any reason. The quaternary ammonium compounds disclosed in Eckles, which happen to have the quaternary nitrogen atom in a heterocyclic ring, are clearly taught as brighteners for an electroplating bath. *There is no need for a brightener in an immersion plating bath.* In fact, as stated in the Declaration, such a compound would likely interfere with the immersion plating process. As is well known in the art, immersion plating processes deposit only a very thin layer of metal (in this case a zinc alloy) on a metal substrate. This is because the deposition process is self-limiting since it can only proceed as long as there are exposed atoms of the substrate metal available for replacement by the immersion plated metal. Due to the very thin layer, which will be covered by a much thicker layer subsequently, there is no need and no purpose for including a brightener. Thus, one would not look to Eckles for any reason, if one sought to modify the Heiman immersion plating system.

Furthermore, Heiman fails to recognize the need for an inhibitor in his baths. The present inventors discovered that it is possible to obtain a highly desirable zinc

alloy layer by immersion plating with use of the inhibitor. The inhibitor inhibits deposition of the more noble metal, nickel and/or cobalt, relative to the less noble zinc. In the absence of the inhibitor, the more noble metal, nickel and/or cobalt, would preferentially deposit, resulting in a predominantly nickel and/or cobalt coating, not a zinc alloy coating as claimed. The inventors discovered that with use of the claimed inhibitor, the desired zinc alloy coating could be obtained. Heiman contains no recognition of this problem and no motivation to look elsewhere for any bath additive.

Furthermore, as stated in the Declaration, if the immersion plating bath is used without the inhibitor, a relatively thick, spongy layer of deposited metal is obtained, and this is not suitable for subsequent over-plating by electroless plating or electroplating.

#### **Discussion of Facts Shown in Declaration of Nayan H. Joshi Under 37 CFR 1.132**

Applicants submit herewith the Declaration of Nayan H. Joshi under 37 CFR 1.132. Dr. Joshi is an inventor on the present application and is a person of skill in the art of metal finishing.

As stated in paragraphs (2) and (3), immersion plating processes are intended to provide an initial coating, e.g., a protective coating to protect the substrate from oxidation, and the initial coating is intended to be covered by a much thicker layer deposited by a process such as electroless plating or electroplating.

As stated in paragraph (4), in the absence of the claimed inhibitor, an unacceptable deposit would be obtained in which the rate of deposition of the alloy metals could not be controlled. The claimed inhibitor provides such control.

As stated in paragraph (5), the function of a brightener in an electroplating bath is to be attracted to the cathode along with the positively charged metal ions, where it performs its function and causes the electrodeposited metal atoms to form a more reflective, brighter surface.

As stated in paragraph (6), there is no reason any person of ordinary skill in the art would add a brightener to an immersion plating bath. There is no function to be performed by such an additive in such a bath or process.

As stated in paragraph (7), it would not have been obvious to add to the bath of Heiman a brightener as disclosed by Eckles et al. because there is no reason, there is no function to be performed by a brightener, and it would not be done for a number of reasons, discussed in more detail in paragraph (9).

As stated in paragraph (8), the bath of Heiman would have a pH more than 100 times more acidic than either the claimed immersion plating bath or the electroplating bath of Eckles et al. Heiman teaches away from such a change, by his teachings that the minimum HF concentration is 0.2 N. As stated, to make such a change would not be optimization, it would be in direct conflict with the explicit teachings of the reference.

As stated in paragraph (9), there are at least five reasons that a person of skill in the art would not attempt to deposit a coating by converting an immersion plating bath to an electroplating bath, despite the suggestion in Heiman that this possibly could be done with the particular bath disclosed therein. For those reasons, persons of ordinary skill in the art would not consider that immersion plating is in any way equivalent to or interchangeable with electroplating.

As stated in paragraph (10), although Eckles et al. discloses a quaternary ammonium compound that contains a nitrogen-containing heterocycle, the compound disclosed by Eckles et al. would not function as an inhibitor in the immersion plating bath of the present invention. To the contrary, this compound may interfere with the immersion plating process.

As stated in paragraph (11), there is no reason any person of ordinary skill in the art would look to Eckles et al. There would be no motivation and there is certainly no suggestion to use a brightener, such as those disclosed by Eckles et al. for the electroplating bath, in an immersion plating bath.

As stated in paragraph (12), the contention that changing the pH would have been mere optimization is clearly erroneous, due to the large difference in the pHs and due to the clear teaching in Heiman that HF must be at least 0.2 N in the bath.

As stated in paragraph (13), if the fluoride salts disclosed by Heiman were used, the pH would still be very low, much lower than the claimed range.

Finally, as stated in paragraph (14), brighteners are not used in immersion plating, and so it would not have been obvious for any person of ordinary skill in the art to have looked to Eckles et al. for a brightener to add to the bath of Heiman.

Based on the facts set forth in the Declaration, and for the reasons set forth herein, Applicants respectfully submit that the present invention would not have been obvious over the prior art, and in particular would not have been obvious over the asserted combination of Heiman and Eckles et al.